

# Integrated Science 1001X (2021–22)

## Exploring the Landscape of Science

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### *Modifications due to COVID-19*

Integrated Science 1001X is intended to be an in-person course. Up until Western's anticipated return to in-person learning on January 31, all learning activities will be online. The 1001X OWL site will contain an up-to-date calendar with the when and whereabouts of the learning activities.

The Zoom meeting information for online activities is as follows:

<https://westernuniversity.zoom.us/j/92216726417>

Meeting ID: 922 1672 6417

Passcode: 1001X

In the event of a COVID-19 resurgence after the return date of January 31 that necessitates the course delivery moving away from face-to-face interaction, the course will pivot to online learning, either synchronously or asynchronously. Details will be provided as needed. The grading scheme will **not** change. Any remaining assessments will also be conducted online.

Most tests and exams are intended to be in-person assessments. In the event that one or more of these assessments need to be conducted online due to COVID-19 or another academic reason, they may be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: <https://remoteproctoring.uwo.ca>.

The entire Integrated Science 1001X team is committed to your success in these difficult and uncertain times and will always keep you informed of any new developments.

# Course Description & Prerequisite Requirements

Calendar description: *Foundational topics of biology, chemistry, computer science, earth science and physics learned through an integrated problem-based approach. Small-group interactions and integrated laboratory experiments will foster teamwork and develop problem-solving and critical-thinking skills. The importance of mathematical approaches and the use of statistics will be emphasized throughout the course.*

Extra information: 13 lecture hours and 10 laboratory/tutorial hours per week, 2.0 course.

Prerequisites: Enrollment in Year 1 of the Western Integrated Science program and a minimum of 60% in each of Calculus 1000A/B or 1500A/B, Chemistry 1301A/B, and Physics 1201A/B or 1501A/B.

Antirequisites: Chemistry 1302A/B; Physics 1029A/B, 1202A/B, 1302A/B and 1502A/B; Biology 1002A/B; Mathematics 1225A/B; and Calculus 1301A/B and 1501A/B.

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

## Course Website

News and course updates will be posted on Western's learning management system, OWL (<http://owl.uwo.ca>). This is the primary method by which information will be disseminated to all students in the class, so you are responsible for checking OWL on a frequent basis.

If you need technical assistance with OWL, seek support on the OWL Help page. Alternatively, contact the Western Technology Services Helpdesk by phone at 519-661-3800.

## Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at 519-661-2147 if you have questions regarding accommodation.

The university's policy on Accommodation for Students with Disabilities can be found here: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic%20Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf)

Learning-skills professionals at Learning Development & Success (<https://www.uwo.ca/sdc/learning>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Health and Wellness (<https://www.uwo.ca/health>) for a list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/your-services>.

## *Diversity and Inclusion*

In an ideal world, science would be objective. However, much of science is subjective and is historically built on a small subset of privileged voices.

In 1001X, we will make an effort to acknowledge a diverse group of scientists, but limits still exist on this diversity. It is possible that there may be both overt and covert biases in the material due to the lens with which it was written, even though the material is primarily of a scientific nature. Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

We would like to discuss issues of diversity in science as part of the course from time to time. Please contact us (in person or electronically) or submit confidential feedback if you have any suggestions to improve the quality of the course materials.

Furthermore, we would like to create a learning environment for everyone that supports diverse thoughts, perspectives, and experiences, and honours your identities (including race, gender, gender identity, class, sexuality, religion, ability, etc.). To help accomplish this: If you have a name and/or set of pronouns that differ from those that appear in your official Western records, please let us know. If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with us. We want to be a resource for you. Remember that you can also submit confidential feedback (which will lead to us making a general announcement to the class, if necessary, to address your concerns – without identifying you).

If you prefer to speak with someone outside of the course, your academic counsellors are an excellent resource. We, like many people, are still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to us about it. Again, your feedback will always be confidential. As a participant in course discussions, you should also strive to honour the diversity of your classmates.

# Learning Outcomes

Broadly speaking, a student receiving credit for the course will be expected to reliably demonstrate competence in their ability to:

- Think critically about, explain, integrate, and apply scientific principles, laws, and theories.
- Solve a variety of novel problems, whether qualitative, quantitative, or mathematical.
- Draw scientific conclusions from experimental results or data.
- Examine, integrate, and assess any provided or collected scientific data.
- Communicate scientific thoughts and ideas in writing.
- Obtain, evaluate, and integrate information from various sources, and determine its relevance.
- Analyze and critically assess problems, and take a systematic approach to solving them.
- Use a variety of laboratory equipment and instrumentation.
- Safely execute a variety of experimental procedures and explain the theory behind them.
- Form productive and collaborative working relationships with other individuals.
- Prioritize a set of tasks and manage the use of their time.

## Class and Personnel Information

Classes, when in-person, will take place at the times and locations specified below. When it is not possible to have them in-person, they will be offered synchronously via Zoom at the same times.

- Mon and Fri                      9:30–11:30      PAB 106
- Tue, Wed, and Thu            9:30–12:30      PAB 106

Contact information for the course personnel:

Instructor	Office	Email
Christina Booker	CHB 21	cbooker2@uwo.ca
Gurpaul Kochhar	MSA 1201	gkochhar@uwo.ca
Felix Lee (course coordinator)	MSA 1202	flee32@uwo.ca
Denis Maxwell	NCB 240	dmaxwell@uwo.ca
Sheri Molnar	BGS 1040	smolnar8@uwo.ca
Bryan Sarlo	MC 361	bsarlo@uwo.ca
Rasul Shafikov	MC 112	shafikov@uwo.ca
Renee Webber (lab supervisor)	CHB 380A	rwebbe@uwo.ca

Remember, we are here to support you! If you find yourself not understanding the lectures, assigned readings, or problems, please come to our scheduled office hours, which will be posted on OWL, or set up an appointment by sending an email **from your Western email account**.

## *Laboratory and Tutorial Sections*

There are up to two laboratory sessions and two tutorial/teamwork sessions per week. The days and times for these sessions depend on the section in which you are registered.

Please see OWL for more info, especially for online activities. For most (but not all) in-person activities:

### **Section 002**

- Mondays and Wednesdays: laboratory from 1:30–4:30 in CHB 380
- Tuesdays and Thursdays: tutorial/teamwork from 1:30–3:30 in SSC 3006

### **Section 003**

- Tuesdays and Thursdays: laboratory from 1:30–4:30 in CHB 380
- Mondays and Wednesdays: tutorial/teamwork from 1:30–3:30 in AHB 2B02

## *Course Materials*

All of the materials below are required. Some of these materials are the same as the ones you had used in the first term. (Laboratory manuals do not need to be purchased. Experiments, tutorials, exercises, etc. will be available on OWL for download.)

1. *Calculus, Volume 2*, by Strang, Herman, et al. The open-source textbook is found at: <https://openstax.org/details/books/calculus-volume-2>
2. *Chemistry 1302B Course Workbook*, 2021–22 edition. It is only available in paper format at the Western bookstore.
3. *Physics for Scientists and Engineers*, 2<sup>nd</sup> edition, by Hawkes et al.
4. *Programming in Python 3 with zyLabs*, an online book
  - Sign in or create an account at [learn.zybooks.com](https://learn.zybooks.com)
    - Be sure that your account uses your official name and your uwo.ca email
  - Enter zyBook code UWOINTEGSCI1001XSarloWinter2021
  - Choose your desired package (school term only, or school term + 1 year), enter your payment information, and click Subscribe.
5. Proper laboratory attire, including lab coat, safety glasses, pants, socks, and shoes without any openings or holes.
6. Non-programmable scientific calculator
7. USB flash drive for transferring data from lab computers

# *Overview of Course Topics – by Question*

Integrated Science 1001X takes a different approach to science education by addressing four broad questions, each one of which addresses the learning outcomes found in the traditional, first-year science courses. A non-exhaustive list of the topics in each question is provided below. The approximate start dates for each question are subject to revision.

1. How did Earth evolve? (starts January 10)
  - Evolution of the universe
  - Formation and evolution of planets and atmospheres
  - Rocks, minerals, plate tectonics, and geophysics
  - Evolution of the periodic table
  - Climate change
  - Evolution of life
2. What is energy, and how do we harness it? (starts February 7)
  - Mechanical energy, including wind and water
  - Fossil fuels and combustion
  - Solar energy
  - Electrical energy and magnetism
  - Nuclear energy
  - Photosynthesis and biological energy
3. What is life? (starts March 17)
  - Structure, function, and regulation of proteins and nucleic acids
  - Thermodynamics of life and equilibrium processes
  - Cellular metabolism
  - Adaptation to extreme environments
  - Bioinformatics
4. How does my smartphone work? (starts January 10 and lasts the duration of the course)
  - Computing and applications
  - Fundamentals of programming and programming structures
  - Methods of input and output
  - Debugging code
  - Visualization
  - Machine learning
  - Minerals, materials, and semiconductors
  - Batteries, energy management, and overheating

Because mathematics (especially calculus) is an essential tool in science and in these topics, a certain number of classes has been dedicated to mathematics.

# *Overview of Course Topics – by Subject*

The Faculty of Science considers Integrated Science 1001X to be an acceptable substitute for Biology 1002A/B, Calculus 1301A/B, Chemistry 1302A/B, and Physics 1202A/B. Listed below is a non-exhaustive summary of the topics in the four above subject areas that are covered in 1001X. A list of the topics in the computer science component of 1001X is also provided.

- Biology
  - Molecular genetics and evolution
  - Proteins: structure, denaturation, enzymes, evolution
  - Membranes: structure, function
  - Photosynthesis, cellular respiration, and bioenergetics
- Calculus
  - Integration techniques
  - Improper integrals
  - Differential equations
  - Modelling and differential equations
  - Series with constant coefficients
  - Representation of function as power series
  - Parametric and polar curves
  - Probability and the central limit theorem (time-permitting)
- Chemistry
  - Gases: ideal gases, gas stoichiometry, kinetic molecular theory
  - Thermodynamics: heat and work, calorimetry
  - Thermochemistry: enthalpy, entropy, free energy
  - Equilibrium: equilibrium constant, solubility, weak acids/bases, buffers
  - Electrochemistry: redox, voltaic cells, electrolytic cells, batteries
  - Kinetics: rates and rate laws, Arrhenius theory, mechanisms
- Physics
  - Energy: units of measurement, laws of thermodynamics, Joule's experiment
  - Electricity: electric fields, point charges and dipoles, potential difference
  - Circuits: voltage, current, Ohm's Law, power, capacitance
  - Waves: SHM, wave parameters, energy, superposition
  - Magnetism: motion of charged particles, magnetic flux, Faraday's and Lenz's laws
- Computer science
  - Variable types: primitive types, containers
  - Conditionals and loops: truth tables, if-else statements, while loops, for loops
  - Functions: variable scope, return statements, recursion
  - I/O: reading from files, writing to files, user input, exception handling
  - Machine learning: supervised and unsupervised methods
  - Visualizations: graphs, plots, image processing

# Evaluation

## Breakdown by Subject

The overall course grade will be calculated out of 200 points. Of the 200 points, 85 will be based on various deliverables (assignments, lab reports, etc.), while the remaining 115 points will be based on assessments (quizzes, tests, and exams). The grade submitted to the Registrar at the end of the term will be expressed as a percentage of the 200 points.

The 200 points are allocated to the various subject areas in 1001X according to the following table. At the end of the term, you will receive your course grade based on the 200 points as well as the points earned in each of the subject areas.

Subject	Deliverables	Assessments	Total
Astronomy	6	4	10
Biology	10	20	30
Chemistry	15	25	40
Computer Science	14	6	20
Earth Sciences	14	6	20
Mathematical Sciences	9.5	30.5	40
Physics	16.5	23.5	40
<b>Total</b>	<b>85</b>	<b>115</b>	<b>200</b>

The points within each subject are allocated to the four questions, but not necessarily with equal weight. Please see the *Master Schedule* on OWL that shows the important dates and point values for the various components. This *Master Schedule* constitutes part of the course outline, because it contains a breakdown of the evaluation scheme and the important dates.

## Deliverables

Deliverables include assignments, exercises, lab reports, and all other learning activities *other than* quizzes, tests, and exams.

Unless otherwise stated, deliverables that are submitted past the deadline will incur a penalty of 20% of the full value of the deliverable. An additional 20% penalty will apply for each additional day that the deliverable is late. These penalties obviously do not apply if you have received academic consideration (see section on Student Absences).



## Assessments

Quizzes, tests, and exams, and their approximate dates, are listed below.

- One 50-minute, in-class math quiz on Thursday, February 3
- One 110-minute, in-class test on Question #1 on Monday, February 7
- One 50-minute, in-class computer science quiz on Wednesday, February 16
- Midterms: chemistry on Monday, February 28; physics on Wednesday, March 2; biology & earth sciences on Friday, March 4; and math on Monday, March 7
- One 50-minute, in-class biology quiz on Monday, March 28
- One 50-minute, in-class math quiz on Thursday, March 31
- One 50-minute, in-class computer science quiz on Wednesday, April 6
- Four 3.0-hour cumulative final exams to be scheduled by the Registrar during the April exam period. The four exams are math, chemistry, biology, and physics, and they will be at the same time as the exams for Bio 1002B, Calc 1301B, Chem 1302B, and Physics 1202B. These times will *not* appear on your exam schedule, so we will provide more details as they become available.

## Requirements for Passing Course

**To obtain credit for 1001X as a whole, all three requirements below must be met:**

1. Obtain a minimum of 50% on the overall course grade.
2. Obtain a minimum of 50% on the total of all of the points associated with lab activities.
3. Obtain credit for each of the chemistry, biology, physics, and math components of 1001X, as described below.
  - a. Obtain at least 50% of the points allocated to the subject itself.
  - b. Obtain at least 50% of the points associated with the laboratory activities in that subject, if that subject has laboratory activities.
  - c. Miss, whether excused or not, no more than one-third of the laboratory activities associated with the subject, if that subject has laboratory activities.
  - d. Obtain at least 40% of the points associated with the final exam in that subject.

Students who fail to meet requirement #2 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for 1001X.

Students who fail to meet requirement #3 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for 1001X. However, these students may take, in the summer of 2021, the traditional first-year course that most closely aligns with the subject for which credit in 1001X was not obtained. The grade obtained in the traditional course will be used to calculate a new 1001X grade. The eligible traditional courses are Chem 1302B, Physics 1202B or 1502B, Calculus 1301B or 1501B, and Biology 1002B.

## Other notes

A missed experiment is assigned a mark of zero unless it has been “excused” (see section on Student Absences).

Audience response systems (“clickers”) may be used to collect information during class. The data collected using the devices will not be used for research purposes without your consent.

Aside from a calculator, no other electronic devices (phones, iPods, etc.) may be in your possession during tests and exams, even for timekeeping purposes.

## *Student Absences*

Students who experience an extenuating circumstance (such as illness or injury) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
  - An absence must be no more than 48 hours
  - The assessment must be worth no more than 30% of the course grade
  - No more than two SRAs may be submitted during the Fall/Winter term
- For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling Office of your home faculty.**

For more information, please consult Western’s policy on academic consideration for absences:  
[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_illness.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf)

For the Student Medical Certificate (SMC), please see:  
[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

Religious Accommodation: When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

## Missed Labs

There are no make-up in-person labs, and it is not possible to reschedule them. If academic consideration has been approved, the other labs within the same subject as the missed lab will be reweighted.

## Late Deliverables

If your reason for not being able to fulfill an academic commitment on time has been approved, either through the self-reporting system or through your faculty's Academic Counselling Office, your deliverable will be marked without any penalty. Pass/fail tutorial components may be excused instead of a make-up being offered.

## Missed Quiz, Test, or Final Exam

If you are unable to write a quiz, obtain approval for your absence, either through the self-reporting system or through your faculty's Academic Counselling Office.

- Computer science: If the February 16 quiz is missed, its weight will be shifted to the quiz on April 6. If the quiz on April 6 is missed, a make-up quiz will be available.
- Biology: If the March 28 quiz is missed, a make-up will be available.
- Math: If the February 3 quiz is missed, a make-up will be available. If the March 31 quiz is missed, its weight will be shifted to the final exam.

If you are unable to write a test, obtain approval for your absence, either through the self-reporting system or through your faculty's Academic Counselling Office. You will then be able to write a make-up test at a later date. If you are unable to write a make-up test, the weight of the missed test will be shifted to the final exam.

If you are unable to write a Final Exam, contact your faculty's Academic Counselling Office as soon as possible. They will assess your eligibility to write a Special Exam in May.

You may also be eligible to write a Special Exam if you are in a "Multiple Exam Situation" (see [http://www.registrar.uwo.ca/examinations/exam\\_schedule.html](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing paperwork in the Faculty of Science's Academic Counselling Office. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the chair of the department or email the Science Students' Council at [ssc@uwo.ca](mailto:ssc@uwo.ca).